

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE  
26 February 1998

3. REPORT TYPE AND DATES COVERED  
Final December 1997

4. TITLE AND SUBTITLE

Naval Signal and Image Analysis Conference Report

5. FUNDING NUMBERS  
G N00014-98-1-0006

6. AUTHORS

Dr. Donald W. Tufts and Brian Freburger

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Department of Electrical and Computer Engineering  
University of Rhode Island  
Kelley Annex  
Kingston, RI 02881

8. PERFORMING ORGANIZATION  
REPORT NUMBER

8. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Office of Naval Research  
ONR 253: Barbara Johnson  
Ballston Centre Tower One, 800 North Quincy Street  
Arlington, VA 22217-5600

10. SPONSORING/MONITORING AGENCY  
REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT  
Approved for public release. Distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

A conference on Naval Signal and Image Processing was held on Tuesday December 2, Wednesday, December 3, and Thursday December 4, 1997 at the Arlington Hilton Hotel in Arlington, Virginia. The meeting was by invitation only and consisted of investigators in the ONR Signal and Image Analysis Program, Navy personnel who have an interest in signal and image processing, as well as other government agency personnel and qualified researchers involved in signal and image analysis. The conference provided an opportunity for technical interaction between academic researchers and Naval scientists and engineers who incorporate signal and image processing algorithms into military systems. In addition, the conference provided a forum to discuss and plan future directions for the ONR Signal and Image Analysis Program as well as informal recommendations to the Program Officer.

19980303 048

14. SUBJECT TERMS

Signal and Image Analysis, signal processing, image processing

15. NUMBER OF PAGES  
8

16. PRICE CODE

17. SECURITY CLASSIFICATION  
OF REPORT  
UNCLASSIFIED

18. SECURITY CLASSIFICATION  
OF THIS PAGE  
UNCLASSIFIED

19. SECURITY CLASSIFICATION  
OF ABSTRACT  
UNCLASSIFIED

20. LIMITATION OF ABSTRACT

NSN 7540-01-280-5500

Computer Generated

STANDARD FORM 298 (Rev 2-89)  
Prescribed by ANSI Std Z39-18  
298-102

DTIC QUALITY INSPECTED 3

Naval Signal and Image Analysis Conference  
Report

February 26, 1998

## 0.1 Conference

A conference on Naval Signal and Image Processing was held on Tuesday December 2, Wednesday, December 3, and Thursday December 4, 1997 at the Arlington Hilton Hotel in Arlington, Virginia. The meeting was by invitation only and consisted of investigators in the ONR Signal and Image Analysis Program, Navy personell who have an interest in signal and image processing, as well as other government agency personell and qualified researchers involved in signal and image analysis. The conference provided an opportunity for technical interaction between academic researchers and Naval scientists and engineers who incorporate signal and image processing algorithms into military systems. In addition, the conference provided a forum to discuss and plan future directions for the ONR Signal and Image Analysis Program as well as informal recommendations to the Program Officer.

A listing of the conference attendees and a listing of the conference presentations is attached. Several breaks were included between talks to encourage interaction and discussion among the attendees.

### 0.1.1 Conference Program

The conference was opened with a talk by Dr. Neil Gerr who discussed the administrative changes taking place in the Office of Naval Research as they pertain to the support of science programs. In the upcoming fiscal year the Signal and Image Analysis and the Sensor Processing programs will change to EO/IR Sensor Processing and RF Sensor Processing respectively. The EO/IR Sensor Processing program will be headed by J. Buss and has been given the task to detect, classify/identify and localize air, sea-surface and ground targets by improved signal/array processing methodologies. The emphasis is on RF sensors that operate between 10MHz and 100GHz. The RF Sensor Processing, headed by William Miceli has been given the task to detect, classify/identify and localize air, sea-surface and ground targets by improving the performance of the signal and image processing techniques associated with electro-optic sensors (passive and active) that operate from the visible through longwave infrared bands. Signal Analysis programs will be moved to the RF Sensors Processing program and Image Analysis will be moved to the EO/IR Sensors Program. The programs of EM Propagation and Interactions, Target Tracking and Sensor Fusion, and Communications and Networking will remain the same. A strong emphasis for the next year

will be ONR's Advanced Multifunction RF Systems (AMRFS) Initiative for enhanced management of RF resources. The purpose of this initiative is to combine the function of many systems using shared antennae resources and electronic subsystems for the reduction of platform RCS and enhanced capabilities. As a final note, the overall program funding has been reduced and a continued reduction should be expected.

This was followed by a presentation from Marina Burgstahler who discussed the areas of signal and image processing development that the Navy needs to fulfill its future needs. The presentation indicated that many of the anticipated areas of operation will be far more challenging with respect to signal processing than current methods can handle. Also, simple extension to the existing traditional methods may not provide a solution. Instead, new approaches based on more modern theories for signal processing may provide improvements. Later in the conference, a presentation was given by Dr. Hoolan from NSWC/Dahlgren on applications of signal and image processing used by the Marine Corps.

The presentations were approximately 20-25 minutes long followed by 5-10 minutes of questions and discussion. Points of interest were then revisited by interested academic and government researchers through informal discussions during periodic breaks scheduled throughout the presentation schedule. Several speakers addressed the use of Time-Frequency transforms in signal and image processing. These talks presented application of time frequency analysis to radar and image detection theory, wide-band signal design, wide-band system design, adaptive detection and classification and chirp detection. A review of some current time-frequency transforms and a new transform which is an extension of the fractional Fourier transform was also presented. Several presentations were given on the use of subspace methods which included an overview of current theories as well as application to radar signal processing, jamming suppression and target tracking. The areas of statistical signal processing, estimation and modeling were treated in several presentation which covered problems in modeling for radar signal processing, uncertain propagation conditions for radar, Hidden Markov models, mixture modeling for adaptive compression, transient signal classification, time varying spectral estimation and the use of Alpha-stable distributions. Two presentations presented new approaches to synthetic aperture radar for improved image quality, detection and classification along with a talk on sonar imaging using laser line scan sensors. Presentations on processing of video images for object detection and an application using neural networks

for image analysis were also given.

## 0.2 Attendance List

### 0.2.1 ONR Conference Organizers

| Name                | Organization             |
|---------------------|--------------------------|
| Burgstahler, Marina | Office of Naval Research |
| Gerr, Dr. Neil      | Office of Naval Research |
| Harned, Nancy       | Office of Naval Research |

### 0.2.2 Government

| Name                  | Organization              |
|-----------------------|---------------------------|
| Bachman, Chip         | Naval Research Laboratory |
| Carpenter, Dr. Bob    | NUWC/Newport              |
| Chan, Francis         | NAVSEA                    |
| Chen, Dr. Victor      | Naval research Laboratory |
| Holland, Dr. Orgal    | NSWC/Dahlgren             |
| Holyer, Dr. Ron       | Naval Research Laboratory |
| Kelly, Dr. Jim        | NUWC/Newport              |
| Lake, Dr. Doug        | Army Research Laboratory  |
| Lee, Dr. Nigel        | NUWC/Newport              |
| Madan, Rabinder       | Office of Naval Research  |
| Marchette, Dave       | NSWC/Dahlgren             |
| Nevis, Dr. Andrew     | NSWC/Panama City          |
| Poston, Dr. Wendy     | NSWC/Dahlgren             |
| Rodriguez, Serafin P. | Naval Research laboratory |
| Rohrbaugh, Dr.        | NSWC/Bremerton            |
| Schwartz, Carey       | NAWC/China Lake           |
| Solka, Dr. Jeff       | NSWC/Dahlgren             |

### 0.2.3 Non-Government

| Name                               | Organization                      |
|------------------------------------|-----------------------------------|
| Barnes, Dr. Chris                  | Georgia Tech Research Institute   |
| Boudreaux-Bartels, Dr. Faye        | University of Rhode Island        |
| Carmona, Dr. Renee                 | Princeton University              |
| Daubechies, Dr. Ingrid             | Princeton University              |
| Freburger, Brian                   | University of Rhode Island        |
| Friedlander, Dr. Ben               | UC Davis                          |
| Fuhrmann, Dr. Dan                  | Washington University             |
| Giannakis, Dr. Georgios            | University of Virginia            |
| Jones, Dr. Doug                    | University of Illinois            |
| Krolik, Dr. Jeff                   | Duke University                   |
| Lii, Dr. Keh-Shin                  | UC Riverside                      |
| Papandreou-Suppappola, Dr. Antonia | University of Rhode Island        |
| Parks, Dr. Thomas                  | Cornell university                |
| Ramchandran, Dr. Kannan            | University of Illinois            |
| Richards, Mark                     | Georgia Tech Research Institute   |
| Richman, Dr.                       | Cornell University                |
| Scharf, Dr. Louis                  | University of Colorado            |
| Schwartz, Dr. Stuart               | Princeton University              |
| Sibul, Dr. Leon                    | ARL, Penn State                   |
| Swindlehurst, Dr.                  | Brigham Young University          |
| Tufts, Dr. Donald                  | University of Rhode Island        |
| Tsakalides                         | University of Southern California |

# Signal and Image Analysis

## Conference

2 - 4 December 1997

Tuesday, 2 December, 1997

| Time | Subject   | Presenter  | Organization                    |
|------|---|--|---------------------------------|
| 0900 | Registration  |  |                                 |
| 0915 | Evolution of the Division Supporting Science Programs   | Dr. Gerr   | Office of Naval Research        |
| 0930 | Naval Applications in Signal and Image Analysis   | Marina Burgstahler                               | Office of Naval Research        |
| 1000 | Applications of Time-Frequency Transforms to Radar Signal and Image Processing  | Dr. Chen   | Naval Research Laboratory       |
| 1030 | Break   |  |                                 |
| 1100 | Time Frequency Derivation of New Wide-Band Probing Signals  | Dr. Parks, Dr. Richman                           | Cornell University              |
| 1130 | New Time-Frequency Representations and Operators  | Dr. Boudreaux-Bartels, Dr. Papandreou-Suppappola | University of Rhode Island      |
| 1200 | Lunch   |  |                                 |
| 1300 | Optimal Time-Frequency-Space Detection with Arrays  | Dr. Jones  | University of Rhode Island      |
| 1330 | Using Unstructured Models in Radar Signal Processing  | Dr. Swindlehurst                                 | Brigham Young University        |
| 1400 | Matched and Adaptive Subspace Detectors for Radar, Sonar and Data Communications  | Dr. Scharf                                       | University of Colorado          |
| 1430 | Break   |  |                                 |
| 1500 | Detection and Classification in Strong, Very Nonstationary Clutter and Interference   | Dr. Tufts, Dr. Freburger                         | University of Rhode Island      |
| 1530 | Generalized Ambiguity Functions and Diversity Techniques for Nonstationary Signal Analysis with Applications to Modeling Maneuvering Targets and Autofocusing SAR Imagery | Dr. Giannakis                                    | University of Virginia          |
| 1600 | SAR and ISAR Surveillance Algorithms Based on a Merger of Iterative Image Formation Processing and Sequential Detection and Classification Techniques                     | Dr. Barnes                                       | Georgia Tech Research Institute |
| 1630 | Adjourn   |  |                                 |

# Signal and Image Analysis Conference

2 - 4 December 1997

Wednesday, 3 December, 1997

| Time | Subject   | Presenter       | Organization                      |
|------|---|-----------------|-----------------------------------|
| 0900 | Over-the-Horizon Radar Target Localization in Uncertain Propagation Conditions                        | Dr. Krolik      | Duke University                   |
| 0930 | A Geometric Approach to Subspace Tracking   | Dr. Fuhrmann    | Washington University             |
| 1000 | Adaptive Multisensor Signal Processing with Alpha-Stable Distributions                                | Dr. Nikias      | University of Southern California |
| 1030 | Break   |                 |                                   |
| 1100 | Statistical Signal and Image Processing Using Wavelet-Domain Hidden Markov Models                     | Dr. Baraniuk    | Rice University                   |
| 1130 | Video-Exploration for Region of Interest Identification   | Dr. Solka       | NSWC/Dahlgren                     |
| 1200 | Lunch   |                 |                                   |
| 1300 | Quick Object Detection  | Dr. Schwartz    | Princeton                         |
| 1330 | Statistical Mixture Modeling of Wavelet Packet Image Decomposition for Effective Adaptive Compression | Dr. Ramchandran | University of Illinois            |
| 1400 | Adaptive Time-Frequency Detection and Classification of Acoustic Signals                              | Dr. Lee         | NUWC/Newport                      |
| 1430 | Break   |                 |                                   |
| 1500 | Characterization and Classification of Transient Signals  | Dr. Rohrbaugh   | NSWC/Bremerton                    |
| 1530 | Marine Corps Applications   | Dr. Holland     | NSWC/Dahlgren                     |
| 1600 | Development of Tracking and Aided Target Recognition Algorithms for the TOPART Radar                  | Dr. Dobberpuhl  | NAWC, China Lake                  |
| 1630 | Adjourn   |                 |                                   |



**Signal and Image Analysis  
Conference**

2 - 4 December 1997

Thursday, 4 December 1997

| <b>Time</b> | <b>Subject</b>   | <b>Presenter</b> | <b>Organization</b>       |
|-------------|--|------------------|---------------------------|
| 0900        | Image Based Grand Tour   | Dr. Poston       | NSWC/Dahlgren             |
| 0930        | Application of Time-Frequency/Time-Scale Transform Techniques to Active Wideband Systems | Dr. Sibul        | ARL, Penn State           |
| 1000        | Time/Frequency Algorithms for Chirp Detection  | Dr. Carmona      | Princeton                 |
| 1030        | Break  |                  |                           |
| 1100        | De-Cluttering of Coherent Structures: Harmonic Signals                                   | Dr. Hurd         | Harry Hurd Assoc.         |
| 1130        | Deblurring and Restoration of Finite Tone Images   | Dr. Lii          | UC Riverside              |
| 1200        | Lunch  |                  |                           |
| 1300        | Neural Networks for Analysis of Hyperspectral Imagery                                    | Dr. Holyer       | Naval Research Laboratory |
| 1330        | Underwater Imaging with Laser Line Scan Sensors  | Dr. Nevis        | NSWC/Panama City          |
| 1400        | Time Varying Spectrum Estimation and Radar Signal Processing                             | Dr. Friedlander  | UC Davis                  |
| 1430        | Adjourn  |                  |                           |